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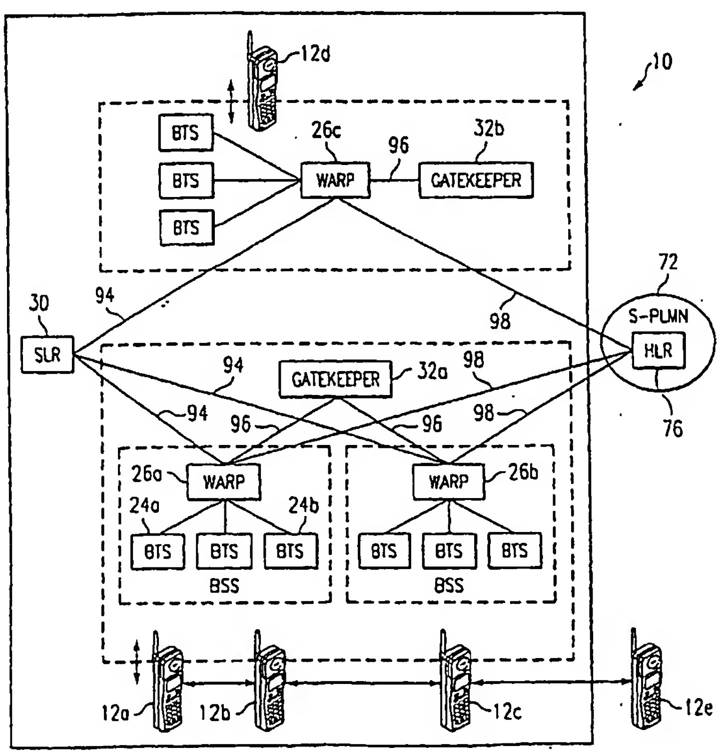
(54) Title: METHOD AND SYSTEM FOR PROVIDING USER MOBILITY BETWEEN PUBLIC AND PRIVATE WIRELESS NETWORKS



(57) Abstract: A system for providing user mobility between public and private wireless networks includes a private wireless network (10) having a base station (24) operable to communicate with a mobile station (12) over a wireless interface (48). The system also includes a wireless adjunct internet platform (WARP) (26) coupled to the base station (24) and operable to communicate with the mobile station (12) through the base station (24). The WARP is further coupled to a home location register (76) in a public wireless network (44) and is operable to inform the home location register (76) when the mobile station (12) moves into and out of range of the WARP (26).

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METHOD AND SYSTEM FOR PROVIDING USER MOBILITY BETWEEN PUBLIC AND PRIVATE WIRELESS NETWORKS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is related to the following applications:

U.S. Application Serial No. 09/128,553, filed on August 3, 1998, and entitled "A 'Plug and Play' Wireless Architecture Supporting Packet Data and IP Voice/Multimedia Services," pending; and

U.S. Application Serial No. 09/219,539, filed on December 23, 1998, and entitled "Wireless Local Loop System Supporting Voice/IP," pending.

All of the following applications are related:

U.S. Application Serial No. 09/499,921, filed concurrently herewith, and entitled "Method and System for Interworking Voice Bearer Messages Between Circuit-Switched and Packet-Switched Networks," pending;

U.S. Application Serial No. 09/499,923, filed concurrently herewith, and entitled "Method and System for Interworking Voice Signaling Messages Between Circuit-Switched and Packet-Switched Networks," pending;

U.S. Application Serial No. 09/500,751, filed concurrently herewith and entitled "Method and System for Incorporating Legacy Private Branch Exchange Features in a Wireless Network," pending;

U.S. Application Serial No. 09/500,379, filed concurrently herewith, and entitled "Method and System for Providing User Mobility Between Public and Private Wireless Networks," pending; and

U.S. Application Serial No. 09/499,922, filed concurrently herewith, and entitled "Method and System for Providing Management Protocol Mediation in Wireless Communications Networks," pending.

These applications have been commonly assigned to Opuswave Networks, Inc.

TECHNICAL FIELD OF THE INVENTION

This invention relates generally to the field of telecommunications and, more specifically, to a method and system for providing user mobility between public and private wireless networks.

BACKGROUND OF THE INVENTION

Private branch exchanges, or PBXs, are well-known in the art of telecommunications. Corporations, organizations, and other enterprises typically use PBXs to provide internal telephone services to their personnel. The personnel may call one another without using an external switched public telephone network, although the PBX is coupled to the public telephone networks for making external local and long distance calls. Telephones are usually coupled to the PBX by wireline connections. PBXs also typically implement a variety of features, including call waiting, call forwarding, conferencing, and call blocking.

Packet-switched computer networks are also common. Corporations and other enterprises typically use the computer networks to provide computer and data services to their personnel. The networks often take the form of a Local Area Network (LAN), a Wide Area Network (WAN), or a Metropolitan Area Network (MAN). These networks typically are used to transfer and share data files and to send and receive e-mail. In addition, developments in the area of Voice over IP (VoIP) allow the packet-switched networks to transmit voice messages.

Recently, interest in wireless networks has increased. Wireless networks allow mobile stations, or wireless units, to communicate over a wireless interface. The mobile station may be a wireless telephone communicating with a voice network over the wireless interface. The mobile station may also be a computer communicating with a data network over the wireless interface. Wireless communications may be over private or public networks. Operators of the wireless networks often wish to integrate the wireless networks into the existing PBXs and computer networks.

The PBX, wireless network, and computer network are usually separate networks since each of them often uses different protocols to transfer messages and

manage elements of the network. The inability to fully integrate the wireless network with the PBX and computer network inhibits the wireless network from performing several key functions. Without full integration, mobile station users may have difficulty accessing the PBX and the computer network. Also, the mobile station users may not be able to roam between the private wireless network and the public wireless network. The mobile station user cannot move in and out of the private wireless network while talking. Instead, the user has to terminate the call, move to the other network, and reestablish a connection. In addition, the inability to fully integrate the networks may force the mobile station users to have two different wireless phones, one for the private wireless network and one for the public wireless network. Further, to provide PBX features in a wireless network, the wireless network operator typically installs substantial hardware and/or software in the wireless network to provide these features. However, even though the PBX-like features are implemented in the wireless network, the PBX and the wireless network still remain separate.

SUMMARY OF THE INVENTION

In accordance with the present invention, a method and system for providing user mobility between public and private wireless networks is provided that substantially eliminates or reduces disadvantages and problems associated with previously developed systems and methods.

A system for providing user mobility between public and private wireless networks is disclosed. The system comprises a private wireless network having a base station operable to communicate with a mobile station over a wireless interface. The system also comprises a wireless adjunct internet platform (WARP) coupled to the base station and operable to communicate with the mobile station through the base station. The WARP is further coupled to a home location register in a public wireless network and is operable to inform the home location register when the mobile station moves into and out of range of the WARP.

A method of providing user mobility between public and private wireless networks is also disclosed. The method comprises the step of registering a mobile

station with a WARP located in a first network when the mobile station begins communicating with the WARP through a base station. The method also comprises the step of informing a home location register in a second network when the mobile station moves into and out of range of the WARP.

A technical advantage of the present invention is that the wireless network can work with an existing PBX, eliminating any need to remove or replace the existing PBX. This reduces the cost of the equipment and the cost of installing the wireless network. Another technical advantage of the present invention is that the wireless network, once integrated into the other networks, can make use of the features currently installed in the existing PBX. In addition, mobile station users only need one wireless phone, rather than one for the public wireless network and one for the private wireless network. Further, the wireless network can be fully integrated with the existing PBX and the computer network, even though the networks may use different message transfer and management protocols. Mobile stations can use the existing PBX to gain access to external voice networks like the public phone systems, and the mobile stations can use the computer network to gain access to external data networks like the Internet. The mobile station users may also roam between the private wireless network and the public wireless network without terminating a call and reestablishing a connection.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, and for further features and advantages, reference is now made to the following description, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 illustrates a private communications network, including a wireless adjunct internet platform (WARP) and a subscriber location register, coupled to existing public and private voice and data networks in accordance with the teachings of the present invention;

FIGURE 2 illustrates, in greater detail, the WARP of FIGURE 1;

FIGURE 3 illustrates, in greater detail, the integration of the private communications network and a public mobile land network (PLMN);

FIGURE 4 illustrates the hierarchical structure of the elements of the private communications network used in a mobility management plane to provide user mobility;

FIGURE 5 illustrates, in greater detail, the mobility management architecture of the WARP and the subscriber location register of FIGURE 4;

FIGURE 6 illustrates, in greater detail, the architecture of the mobility management plane that allows users of mobile stations to roam within the private communications network;

FIGURE 7 illustrates, in greater detail, the architecture of the mobility management plane that allows users of mobile stations to roam between the private communications network and the PLMN;

FIGURE 8 illustrates, in greater detail, the architecture of the mobility management plane that allows subscriber management information to be stored and retrieved from the subscriber location register;

FIGURE 9 is a flowchart illustrating the operation of the elements of the private communications network in providing user mobility within the private communications network;

FIGURE 10 is a flowchart illustrating an interworking function performed by the WARP to integrate the private communications network with a packet-switched network; and

FIGURE 11 is a flowchart illustrating another interworking function performed by the WARP to integrate the private communications network with a packet-switched network.

DETAILED DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention and its advantages are best understood by referring to FIGURES 1 through 11 of the drawings, like numerals being used for like and corresponding parts of the various drawings.

FIGURE 1 illustrates a private communications network coupled to existing public and private voice and data networks in accordance with the teachings of the present invention. Private network 10 comprises one or more mobile stations (MS)

12, a wireless subsystem (WSS) 14, a packet switching subsystem (PSS) 16, a private branch exchange (PBX) 18, and an Internet Protocol (IP) network 20.

Mobile station 12 comprises any device capable of communicating with a base station 24 over a wireless interface 48. Mobile station 12 may comprise, for example, a Global System for Mobile communication (GSM) mobile station capable of delivering a circuit-switched speech service. Alternatively, mobile station 12 may comprise a portable computer with a microphone or a phone coupled to a wireless modem. Mobile station 12 may also comprise a computer and a phone coupled to a radio unit. In this document, the terms "couple," "coupled," and "coupling" refer to any direct or indirect connection between two elements within private network 10, whether or not the two elements are in physical contact with one another.

Wireless subsystem 14 comprises one or more base station subsystems (BSS) 22. Each base station subsystem 22 comprises a base transceiver station (BTS) 24, also called a base station 24, and a wireless adjunct internet platform (WARP) 26.

Base station 24 is coupled to WARP 26 by an interface 28. Base station 24 also provides bi-directional communication with mobile station 12 in a specified geographic area over wireless interface 48. Base station 24 is operable to transfer messages between mobile station 12 and WARP 26. Base station 24 may comprise, for example, one or more transceivers capable of transmitting and receiving circuit-switched messages from mobile station 12 over wireless interface 48. In one embodiment, base station 24 and mobile station 12 communicate using the GSM 04.08 signaling message and 08.60 bearer message protocols.

Wireless interface 48 couples mobile station 12 and base station 24. In this document, the term "wireless" designates the use of a radio or over-the-air interface to communicate with mobile station 12. Wireless interface 48 may comprise any of a number of available wireless interfaces capable of transferring circuit-switched messages between mobile station 12 and base station 24. In one embodiment, mobile station 12 and base station 24 communicate using the GSM General Packet Radio Service (GSM/GPRS) interface. In another embodiment, base station 24 and mobile station 12 communicate using the GSM Enhanced Data rates for GSM Evolution (GSM/EDGE) interface.

WARP 26 is coupled to base station 24 by interface 28 and to IP network 20. WARP 26 allows users of mobile stations 12 to gain access to internal networks and to external voice and data networks. In one embodiment, WARP 26 communicates with mobile station 12 through base station 24 using a circuit-switched message protocol, and WARP 26 communicates with IP network 20 using a packet-switched message protocol. WARP 26 also provides interworking for the transmission of messages through private network 10. WARP 26 translates between the circuit-switched and the packet-switched protocols. In one embodiment, WARP 26 converts circuit-switched messages from mobile station 12 into packetized messages suitable for transmission over IP network 20. WARP 26 also converts packetized messages from IP network 20 into circuit-switched messages sent to mobile station 12. In a particular embodiment, WARP 26 uses the architecture specified in the International Telecommunications Union-Telecommunications (ITU-T) H.323 protocol standard for provisioning IP packet voice services.

Interface 28 couples base station 24 and WARP 26. Interface 28 may be any of a number of available interfaces capable of transferring circuit-switched messages between base station 24 and WARP 26. Interface 28 may comprise, for example, a GSM Abis wireline interface.

IP network 20 transmits and receives packet-switched messages from one address in IP network 20 to another address. IP network 20 may comprise any number of available packet-switched networks. IP network 20 may, for example, comprise a Local Area Network or a Wide Area Network. An IP phone 36 and a workstation 38 may also be coupled to IP network 20. IP network 20 may also be coupled to an external data network such as Internet 42 or to an external voice network like a public land mobile network (PLMN) 44.

Packet switching subsystem 16 comprises a subscriber location register (SLR) 30, a gatekeeper (GK) 32, and a PBX gateway (GW) 34. Subscriber location register 30 is coupled to IP network 20. Subscriber location register 30 stores subscriber management information for each mobile station 12. Subscriber location register 30 stores general subscriber management information downloaded from PLMN 44. Subscriber location register 30 also stores each user's extension number, direct dial number, and any other information that is specific to private network 10. Subscriber

location register 30 may comprise, for example, a SUN™ workstation with a database.

PBX gateway 34 is coupled to IP network 20, a PBX 18, and a public switched telephone network (PSTN) 46. PBX gateway 34 communicates with IP network 20 using a packet-switched message protocol. PBX gateway 34 also communicates with PBX 18 or PSTN 46 using a circuit-switched message protocol. PBX gateway 34 provides the interworking functionality between packet-switched messages transmitted to and received from IP network 20 and circuit-switched messages transmitted to and received from PBX 18 or PSTN 46. In one embodiment, PBX gateway 34 communicates over IP network 20 using the ITU-T H.323 protocol standard, PBX gateway 34 communicates with PBX 18 using a PBX interface protocol, and PBX gateway 34 provides the interworking between the protocols.

Gatekeeper 32 is coupled to IP network 20. Gatekeeper 32 provides call control services for mobile stations 12, WARPs 26, and PBX gateway 34. Gatekeeper 32 tracks the location of each mobile station 12, and gatekeeper 32 routes calls to and from the WARP 26 currently serving a particular mobile station 12. This allows users of mobile stations 12 to roam freely between geographic areas covered by different base stations 24.

PBX 18 is coupled to PBX gateway 34, PLMN 44, and PSTN 46. PBX 18 may transmit and receive circuit-switched messages from PBX gateway 34, PLMN 44, and PSTN 46. PBX 18 may also communicate with a telephone 40 coupled to PBX 18. PBX 18 may be any of a number of available PBX networks capable of transmitting and receiving circuit-switched messages. PBX 18 may, for example, be a legacy PBX already installed within an existing private network.

In an alternate embodiment of private network 10, private network 10 replaces a legacy PBX 18. In this embodiment, gatekeeper 32 and PBX gateway 34 perform the functions normally implemented in PBX 18.

Private network 10 uses a mobility management plane to allow users of mobile stations 12 to roam between different base stations 24, between different WARPs 26, and between private network 10 and PLMN 44. Mobility management messages are sent between the elements of private network 10 over the mobility management plane.

The elements of private network 10 may use different protocols to transmit the mobility management messages. The protocols could include, for example, a circuit-switched protocol like the GSM 04.08 protocol and a packet-switched protocol such as the ITU-T H.323 Registration, Admissions, and Status protocol. The mobility management plane could carry circuit-switched mobility management messages as well as packet-switched mobility management messages. WARP 26 provides the interworking functionality needed to convert between the circuit-switched protocol and the packet-switched protocol.

FIGURE 2 illustrates, in greater detail, the WARP 26 of FIGURE 1. WARP 26 comprises an interface card (IC) 52, a processor card (PC) 54, and a random access memory (RAM) 56. Interface card 52 is coupled to base station 24 through interface 28 and to processor card 54. Interface card 52 transmits and receives circuit-switched messages between base station 24 and processor card 54. Interface card 52 may comprise any interface card capable of communicating with base station 24 over interface 28. In one embodiment, base station 24 communicates with interface card 52 over a T1 interface, and interface card 52 comprises a T1 interface card. In another embodiment, interface card 52 comprises a GSM Abis wireline interface card operable to transmit and receive voice messages in GSM Transcoding and Rate Adaptation Unit (TRAU) frames.

Processor card 54 is coupled to interface card 52 and to IP network 20. Processor card 54 performs the interworking between the circuit-switched protocol used by mobile station 12 and the packet-switched protocol used by IP network 20. Processor card 54 may comprise any processor capable of running a real time operating system. In one embodiment, processor card 54 is an INTEL™ PENTIUM™ processor and compatible motherboard.

Random access memory 56 is coupled to processor card 54. RAM 56 is operable to store and retrieve software needed to perform the interworking function and subscriber management information associated with each mobile station 12. RAM 56 may comprise, for example, a non-volatile random access memory or any other hardware, software, firmware, or combination thereof capable of storing and retrieving software for processor card 54. In one embodiment, memory 56 comprises 512 megabytes of non-volatile random access memory.

FIGURE 3 illustrates the integration of private network 10 and PLMN 44. PLMN 44 comprises a serving public land mobile network (S-PLMN) 72 and one or more other public land mobile networks (O-PLMN) 74.

S-PLMN 72 is a public land mobile network that provides wireless communications services in a geographic area where private network 10 is located. Private network 10 is coupled to S-PLMN 72 through IP network 20 and PBX 18. Private network 10 transmits and receives voice and mobility management messages to and from S-PLMN 72. In one embodiment, S-PLMN 72 comprises a GSM public land mobile network.

O-PLMN 74 is a public land mobile network that provides wireless communications services, but not to private network 10. Because O-PLMNs 74 do not provide wireless services to private network 10, private network 10 does not transmit a signal directly to O-PLMNs 74. Instead, private network 10 may communicate with O-PLMN 74 indirectly through S-PLMN 72 or PSTN 46.

S-PLMN 72 comprises a home location register (HLR) 76 and an operations and maintenance center (OMC) 78. Home location register 76 is coupled to IP network 20 through a PLMN gateway (PLMN GW) 70. Home location register 76 handles location management functions for S-PLMN 72. Home location register 76 is operable to transfer general subscriber management information to subscriber location register 30 when each mobile station 12 registers with a WARP 26 within private network 10. Home location register 76 also tracks the location of each mobile station 12. When mobile station 12 moves into private network 10, home location register 76 tracks which WARP 26 is currently serving mobile station 12. If mobile station 12 roams between two WARPs 26, home location register 76 updates the location of mobile station 12. When mobile station 12 leaves private network 10, home location register 76 tracks the location of mobile station 12 within S-PLMN 72. Home location register 76 may comprise, for example, a SUN™ workstation with a database.

OMC 78 is coupled to IP network 20 and PBX network 18. OMC 78 manages the operation of base station subsystems 22 within private network 10. OMC 78 is operable to execute management applications for an operator of S-PLMN 72. OMC 78 may comprise, for example, one or more SUN™ workstations.

PLMN gateway 70 is coupled to IP network 20 and to home location register 76. PLMN gateway 70 provides a transmission interface between private network 10 and S-PLMN 72. Through PLMN gateway 70, private network 10 may exchange circuit-switched mobility management signaling with S-PLMN 72. Private network 10 may also exchange circuit-switched mobility management messages with S-PLMN 72. PLMN gateway 70 may be any of a number of available gateways.

FIGURE 4 illustrates the hierarchical structure of the elements of private network 10 used in the mobility management plane to provide user mobility. In this embodiment, private network 10 comprises multiple base station subsystems 22, each base station subsystem 22 comprising one WARP 26 coupled to three base stations 24. Private network 10 also comprises two gatekeepers 32a and 32b. Gatekeeper 32a is coupled to two WARPs 26a-26b, and gatekeeper 32b is coupled to one WARP 26c.

When mobile station 12 registers with WARP 26, WARP 26 communicates with subscriber location register 30. Subscriber location register 30 contains general and private network-specific subscriber management information. WARP 26 requests the subscriber management information from subscriber location register 30, and subscriber location register 30 transmits the information to WARP 26. WARP 26 and subscriber location register 30 communicate over a Mobility Management over Internet Protocol (MMIP) link 94. MMIP link 94 is operable to transfer the subscriber management information between WARP 26 and subscriber location register 30. The MMIP protocol is a protocol that allows WARP 26 and subscriber location register 30 to communicate over IP network 20.

After WARP 26 receives the subscriber management information from subscriber location register 30, mobile station 12 may move between geographic areas covered by different base stations 24 coupled to the same WARP 26. As mobile station 12 moves from one base station 24 to another, WARP 26 tracks the location of mobile station 12 so WARP 26 can route any incoming voice or data messages to the proper base station 24. To accomplish this, mobile station 12 is operable to communicate with WARP 26 and exchange mobility management messages over the mobility management plane. Mobile station 12 and WARP 26 use the mobility management plane to perform location updating and related mobility management

functions. In one embodiment, mobile station 12 and WARP 26 communicate using the GSM 04.08 protocol.

When mobile station 12 moves from position 12a to 12b, mobile station 12 moves out of the geographic area covered by base station 24a. Mobile station 12 begins communicating with WARP 26a through base station 24b. Base station 24b informs WARP 26a of the location of mobile station 12 so WARP 26a can track mobile station 12 to its new position.

Mobile station 12 may also roam between geographic areas covered by different WARPs 26 connected to the same gatekeeper 32. When mobile station 12 moves between WARPs 26, the new WARP 26 requests the subscriber management information from subscriber location register 30. Subscriber location register 30 transmits the information to the new WARP 26.

Also, as mobile station 12 moves from one WARP 26 to another, gatekeeper 32 and home location register 76 track the location of mobile station 12 so gatekeeper 32 and home location register 76 can route incoming messages for mobile station 12 to the proper WARP 26. To track the location of mobile station 12, WARP 26 is operable to communicate with gatekeeper 32 and home location register 76 and exchange mobility management messages over the mobility management plane. In one embodiment, WARP 26 and gatekeeper 32 communicate using the ITU-T H.323 Registration, Admissions, and Status protocol, and WARP 26 and home location register 76 communicate using the GSM Mobile Application Part (MAP) protocol.

To facilitate the transfer of mobility management messages between WARP 26 and gatekeeper 32, WARP 26 and gatekeeper 32 are coupled by a RAS link 96. In one embodiment, RAS link 96 is operable to transmit ITU-T H.323 Registration, Admissions, and Status protocol messages between WARP 26 and gatekeeper 32. To transfer mobility management messages between WARP 26 and home location register 76, WARP 26 and home location register 76 are coupled by a MAP link 98. In one embodiment, MAP link 98 is operable to transmit GSM Mobile Application Part protocol messages between WARP 26 and home location register 76.

When mobile station 12 moves from position 12b to 12c, mobile station 12 moves out of the geographic area covered by WARP 26a and into the area covered by WARP 26b. WARP 26b informs gatekeeper 32a of the current location of mobile

station 12. WARP 26b also informs home location register 76 of the current position of mobile station 12, and home location register 76 instructs WARP 26a to purge subscriber management information for mobile station 12 from random access memory 56.

Mobile station 12 may also roam between two zones controlled by different gatekeepers 32. Each gatekeeper 32 controls a zone, and each zone is defined by the geographic area covered by all WARPs 26 and base stations 24 managed by gatekeeper 32. When mobile station 12 moves from position 12a to 12d, mobile station 12 moves out of the zone controlled by gatekeeper 32a and into the zone of gatekeeper 32b. WARP 26c informs gatekeeper 32b and home location register 76 of the location of mobile station 12 using the mobility management plane. Home location register 76 instructs WARP 26a to purge the subscriber management information for mobile station 12, and WARP 26a informs gatekeeper 32a that mobile station 12 is no longer communicating with WARP 26a.

Mobile station 12 may even roam completely out of the geographic area covered by private network 10. In this case, mobile station 12 moves from private network 10 into S-PLMN 72. As mobile station 12 moves from private network 10 into S-PLMN 72, home location register 76 tracks the new location of mobile station 12. Home location register 76 tracks the current location of mobile station 12 so home location register 76 can route messages for mobile station 12 to either private network 10 or to a location within S-PLMN 72. To track the location of mobile station 12, WARP 26 and home location register 76 communicate and exchange mobility management messages.

When mobile station 12 moves from position 12c to 12e, mobile station 12 moves out of the geographic area covered by private network 10. A Mobile Switching Center/Visitor Location Register (MSC/VLR) in S-PLMN 72 detects mobile station 12 in S-PLMN 72, and the MSC/VLR informs home location register 76 of the position of mobile station 12. Home location register 76 instructs WARP 26b to purge subscriber management information for mobile station 12 from random access memory 56. WARP 26b informs gatekeeper 32a that mobile station 12 has moved out of range of WARP 26b.

Mobile station 12 may also roam into private network 10 by moving from position 12e to position 12c. WARP 26b informs gatekeeper 32a and home location register 76 that mobile station 12 is now communicating with private network 10, and home location register 76 directs messages for mobile station 12 to private network 10.

FIGURE 5 illustrates one embodiment of the mobility management structure of WARP 26 and subscriber location register 30. In this embodiment, WARP 26 comprises a Location Register (LR) 95. Location register 95 stores the location of a mobile station 12 that is currently communicating with WARP 26. The value in location register 95 could represent the base station 24 currently communicating with mobile station 12. Location register 95 could, for example, comprise random access memory 56 of WARP 26.

In one embodiment, subscriber location register 30 comprises a Visitor Location Register (VLR) 97 and an Office Location Register (OLR) 99. Visitor location register 97 is coupled to WARP 26 and to office location register 99. Visitor location register 97 retrieves and stores the general subscriber management information from home location register 76 over MAP link 98 when a mobile station 12 registers with a WARP 26 within private network 10. Visitor location register 97 also transmits the information to WARP 26 when mobile station 12 registers with WARP 26. Visitor location register 97 could comprise, for example, a GSM VLR.

Office location register 99 is coupled to WARP 26 and to visitor location register 97. Office location register 99 stores private network-specific subscriber management information. When mobile station 12 registers with a WARP 26 within private network 10, office location register 99 may transmit the private network–specific subscriber management information to WARP 26.

FIGURE 6 illustrates one embodiment of the architecture of the mobility management plane that allows users of mobile stations 12 to roam within private network 10. The mobility management plane comprises a GSM mobile station protocol stack 100, a base transceiver station protocol stack 120, a WARP protocol stack 140, and a gatekeeper protocol stack 180. In one embodiment, mobility management messages sent between mobile station 12 and WARP 26 on the mobility management plane are based on the GSM 04.08 protocol, and the mobility

management messages sent between WARP 26 and gatekeeper 32 are based on the ITU-T H.323 Registration, Admissions, and Status protocol.

Mobile station protocol stack 100 comprises a physical layer (PHYS) 102, a data link control (DLC) layer 104, a radio resource (RR) management layer 106, and a GSM Mobility Management (GSM MM) layer 108. Base transceiver station protocol stack 120 comprises a physical layer 122, a data link control layer 124, a radio resource management layer 126, a T1/E1 protocol layer 128, an L2 protocol layer 130, and a base transceiver station management (BTSM) layer 132.

WARP protocol stack 140 comprises a T1/E1 protocol layer 142, an L2 protocol layer 144, a base transceiver station management layer 146, a radio resource management layer 148, a GSM mobility management layer 150, an interworking function (IWF) layer 152, an H.323 Registration, Admissions, and Status (RAS) protocol layer 154, a User Datagram Protocol (UDP) layer 156, an Internet Protocol (IP) layer 158, a subnetwork layer 160, and a physical layer 162. Gatekeeper protocol stack 180 comprises a physical layer 182, a subnetwork layer 184, an Internet Protocol layer 186, a UDP layer 188, and an H.323 RAS protocol layer 190.

Physical layers 102 and 122 manage wireless interface 48 between mobile station 12 and base station 24. Data link control layers 104 and 124 and radio resource management layers 106 and 126 allow private network 10 to establish, maintain, and release GSM-managed circuits on wireless interface 48. GSM mobility management layers 108 and 150 support the transfer of mobility management messages between mobile station 12 and WARP 26.

T1/E1 protocol layers 128 and 142 and L2 protocol layers 130 and 144 allow private network 10 to manage the transmission of mobility management messages between base station 24 and WARP 26 using the T1/E1 and L2 transmission protocols. Base transceiver station management layers 132 and 146 allow private network 10 to establish, maintain, and release GSM-managed circuits on wireless interface 48 between mobile station 12 and base station 24.

Interworking function layer 152 in WARP 26 interworks the circuit-switched mobility management protocol used by mobile station 12 and the packet-switched mobility management protocol used by IP network 20. The H.323 RAS layers 154 and 190 support Registration, Admissions, and Status protocol processing by WARP

26 and gatekeeper 32, which includes discovery, management, and location management procedures.

UDP layers 156 and 188, together with Internet Protocol layers 158 and 186, manage and support UDP/IP connections between WARP 26 and gatekeeper 32. The UDP/IP connections are used to transmit Registration, Admissions, and Status mobility management messages.

Subnetwork protocol layers 160 and 184 support subnetwork transmission protocols for transmitting packet-switched mobility management messages between WARP 26 and gatekeeper 32. In one embodiment, subnetwork protocol layers 160 and 184 may be ethernet layers. Physical layers 162 and 182 support the management of the physical transmission interface between WARP 26 and gatekeeper 32.

FIGURE 7 illustrates one embodiment of the architecture of the mobility management plane that allows users of mobile stations 12 to roam between private network 10 and PLMN 44. The architecture of mobile station 12 and base station 24 are the same in FIGURE 7 as in FIGURE 6. In addition, layers 142-150 and layers 158-162 of WARP protocol stack 140 are the same in FIGURE 7 as in FIGURE 6. The mobility management plane further comprises a PLMN gateway protocol stack 220 and a PLMN protocol stack 240.

WARP protocol stack 140 further comprises a Mobile Application Part D, Part E, Part F, Part G (MAP/D/E/F/G) interface layer 164, a Transaction Capability Application Part (TCAP) layer 166, a Signaling Connection Control Part (SCCP) layer 168, a Signaling Connection Control Part Tunneling layer 170, and a Transaction Control Protocol (TCP) layer 172.

PLMN gateway protocol stack 220 comprises a physical layer 222, a subnetwork layer 224, an Internet Protocol layer 226, a TCP layer 228, a SCCP tunneling layer 230, a SCCP layer 232, a Message Transfer Part (MPT) layer 234, and a physical layer 236. PLMN protocol stack 240 comprises a physical layer 242, a MTP layer 244, a SCCP layer 246, a TCAP layer 248, and a MAP/D/E/F/G layer 250.

MAP/D/E/F/G layers 164 and 250 support protocols used in the transmission of Mobile Application Part messages between PLMN 44 and WARP 26. MAP/D/E/F/G layers 164 and 250 support the use of a MAP-D interface, a MAP-E interface, a MAP-F interface, and a MAP-G interface. TCAP layers 166 and 248

support protocols used in the transmission of TCAP messages between WARP 26 and PLMN 44. In one embodiment, the Mobile Application Part and Transmission Capability Application Part messages are defined by the GSM MAP and GSM TCAP protocols.

SCCP layers 168 and 232 support protocols used in the transmission of SCCP messages between WARP 26 and PLMN gateway 70. SCCP tunneling layers 170 and 230 provide the transport for SCCP messages between WARP 26 and PLMN gateway 70 over IP network 20.

TCP layers 172 and 228, along with the Internet Protocol layers 158 and 226, support the use of TCP/IP connections between WARP 26 and PLMN gateway 70. The TCP/IP connections are used to transfer mobility management messages between WARP 26 and PLMN gateway 70.

Physical layers 162 and 222 support the management of the physical transmission interface between WARP 26 and PLMN gateway 70. Subnetwork protocol layers 160 and 224 supports subnetwork transmission protocols for transmitting packet-switched mobility management messages between WARP 26 and PLMN gateway 70. In one embodiment, subnetwork protocol layer 226 may be an ethernet layer.

MTP layers 234 and 244 support transmission protocols used to transfer mobility management messages between PLMN gateway 70 and PLMN 44. Physical layers 236 and 242 support the management of the physical transmission interface between PLMN gateway 70 and PLMN 44. In one embodiment, PLMN gateway 70 and PLMN 44 communicate over a Signaling System 7 (SS7) interface.

Interworking function layer 152 supports the interworking of messages between mobile station 12 and PLMN gateway 70. Interworking function layer 152 also supports the interworking of messages between mobile station 12 and PLMN 44. WARP 26 exchanges GSM Mobility Application Part messages with PLMN 44, and WARP 26 provides the interworking between the GSM 04.08 messages used by mobile station 12 and the GSM Mobility Application Part messages.

FIGURE 8 illustrates one embodiment of the architecture of the mobility management plane that allows subscriber management information to be stored and retrieved from subscriber location register 30. The architecture of mobile station 12

and base station 24 are the same in FIGURE 8 as in FIGURES 6 and 7. In addition, layers 142-150 and layers 156-162 of WARP protocol stack 140 are the same in FIGURE 8 as in FIGURE 6. The mobility management plane also comprises a subscriber location register protocol stack 270.

WARP protocol stack 140 further comprises a Mobility Management over Internet Protocol (MMIP) layer 176. Subscriber location register protocol stack 270 comprises a physical layer 272, a subnetwork layer 274, an Internet Protocol layer 276, a UDP layer 278, and a MMIP layer 280.

MMIP layers 176 and 280 support the transmission of MMIP messages between WARP 26 and subscriber location register 30. The MMIP protocol is a protocol that allows WARP 26 and subscriber location register 30 to transfer mobility management messages over IP network 20.

UDP layers 156 and 278, together with the Internet Protocol layers 158 and 276, manage and support UDP/IP connections between WARP 26 and subscriber location register 30. The UDP/IP connections are used to transmit the MMIP mobility management messages between WARP 26 and subscriber location register 30.

Subnetwork protocol layers 160 and 274 support subnetwork transmission protocols for transmitting packet-switched mobility management messages between WARP 26 and subscriber location register 30. In one embodiment, subnetwork protocol layers 160 and 274 may be ethernet layers. The physical layers 162 and 272 support the management of the physical transmission interface between WARP 26 and subscriber location register 30.

The interworking function layer 152 also supports the interworking of messages between WARP 26 and subscriber location register 30. In one embodiment, WARP 26 communicates with mobile station 12 using the GSM 04.08 protocol and with subscriber location register 30 using the MMIP protocol. WARP 26 provides the interworking between the GSM 04.08 messages and the MMIP messages.

FIGURE 9 is a flowchart illustrating the operation of the elements of private network 10 in providing user mobility within private network 10. WARP 26 waits for a mobile station 12 to register with WARP 26 at a step 320. WARP 26 retrieves subscriber management information associated with mobile station 12 from subscriber location register 30 at a step 322. This may include, for example, retrieving

information from visitor location register 97 and office location register 99 in subscriber location register 30.

WARP 26 stores the current location of mobile station 12 at a step 324. This may include, for example, storing an address of a base station 24 currently communicating with mobile station 12 in location register 95. WARP 26 and mobile station 12 begin transmitting and receiving signals at a step 326. Mobile station 12 roams outside of the current base station 24 at a step 328. Private network 10 uses the mobility management plane to track mobile station 12 to a new location.

Mobile station 12 may roam into an area controlled by a new base station 24 connected to the same WARP 26 at a step 330. If so, mobile station begins communicating with the new base station 24, and the new base station 24 informs WARP 26 of the location of mobile station 12. WARP 26 updates the location of mobile station 12 at a step 332. This may include, for example. storing an address of the new base station 24 that is communicating with mobile station 12 in location register 95. WARP 26 then returns to step 326 and exchanges messages with mobile station 12 through the new base station 24.

Mobile station 12 may roam into an area controlled by a new WARP 26 connected to the same gatekeeper 32 at a step 334. When this occurs, mobile station 12 begins communicating with the new WARP 26. The new WARP 26 stores the current location of mobile station 12, and the new WARP 26 updates gatekeeper 32 and home location register 76 at a step 336. Home location register 76 instructs the old WARP 26 to purge subscriber management information for mobile station 12. The old WARP 26 then returns to step 320 to await another mobile station 12.

Mobile station 12 may roam to a zone outside of the original gatekeeper 32 to a new gatekeeper 32 at a step 338. Mobile station 12 begins communicating with a new WARP 26 connected to the new gatekeeper 32. The new WARP 26 stores the current location of mobile station 12, and the new WARP 26 updates the new gatekeeper 32 and home location register 76 at a step 340. Home location register 76 instructs the old WARP 26 to purge subscriber management information for mobile station 12, and the old WARP 26 updates the old gatekeeper 32. The old WARP 26 returns to step 320 to wait for another mobile station 12 to register.

Mobile station 12 may even roam out of private network 10. When that occurs, a MSC/VLR in S-PLMN 72 detects mobile station 12 at a step 342. The MSC/VLR informs home location register 76 of the current location of mobile station 12, and home location register instructs WARP 26 to purge the subscriber management information for mobile station 12 at a step 344. WARP 26 informs gatekeeper 32 that mobile station 12 is no longer communicating with WARP 26. WARP 26 returns to step 320 to wait for another mobile station 12 to register.

FIGURE 10 is a flowchart illustrating one embodiment of an interworking function performed by WARP 26 used to integrate private network 10 and IP network 20. WARP 26 is initialized at a step 400. WARP 26 waits to receive circuit-switched messages from mobile station 12 at a step 402. In one embodiment, mobile station 12 uses a GSM 04.08 protocol for the messages. The circuit-switched messages may contain a mobility management message and at least one parameter.

When WARP 26 receives a message from mobile station 12, WARP 26 checks to see if the circuit-switched message contains a mobility management message that is supported in the packet-switched protocol at a step 404. In one embodiment, WARP 26 checks to see if the GSM 04.08 message is supported in the ITU-T H.323 protocol. If not, WARP 26 determines that the mobility management message is not supported in the ITU-T H.323 protocol at a step 406. WARP 26 may take an appropriate action, such as returning an error message to mobile station 12. WARP 26 returns to step 402 to await another message from mobile station 12.

If the mobility management message is supported in the packet-switched protocol, WARP 26 performs an interworking function 407. WARP 26 maps the mobility management message from the circuit-switched protocol to an equivalent packet-switched protocol message at a step 408. WARP 26 maps the parameters sent in the circuit-switched message to equivalent packet-switched protocol parameters at a step 410. WARP 26 composes a packet-switched message using the equivalent packet-switched mobility management message and parameters at a step 412. WARP 26 transmits the composed packet-switched message to IP network 20 at a step 414. WARP 26 returns to step 402 to await another message from mobile station 12.

FIGURE 11 is a flowchart illustrating one embodiment of another interworking function performed by WARP 26 used to integrate private network 10

and IP network 20. WARP 26 is initialized at a step 420. WARP 26 waits to receive packet-switched messages from IP network 20 at a step 422. In one embodiment, IP network 20 uses the ITU-T H.323 protocol for the messages. The packet-switched messages may contain a mobility management message and at least one parameter.

When WARP 26 receives a message from IP network 20, WARP 26 checks to see if the packet-switched message contains a mobility management message that is supported in the circuit-switched protocol at a step 424. In one embodiment, WARP 26 checks to see if the ITU-T H.323 message is supported in the GSM 04.08 protocol. If not, WARP 26 determines that the mobility management message is not supported in the GSM 04.08 protocol at a step 426. WARP 26 may take an appropriate action, such as returning an error message to IP network 20. WARP 26 returns to step 422 to await another message from IP network 20.

If the mobility management message is supported in the circuit-switched protocol, WARP 26 performs an interworking function 427. WARP 26 maps the mobility management message from the packet-switched protocol to an equivalent circuit-switched protocol message at a step 428. WARP 26 maps the parameters sent in the packet-switched message to equivalent circuit-switched protocol parameters at a step 430. WARP 26 composes a circuit-switched message using the equivalent circuit-switched mobility management message and parameters at a step 432. WARP 26 transmits the composed circuit-switched message to mobile station 12 at a step 434. WARP 26 returns to step 422 to await another message from IP network 20.

The methods shown in FIGURES 10 and 11 show the interworking between GSM circuit-switched signaling messages and H.323 packet-switched messages. A similar method can be used by WARP 26 to provide the interworking between GSM 04.08 messages and GSM Mobility Application Part messages and between GSM 04.08 messages and MMIP messages.

Although an embodiment of the invention and its advantages are described in detail, a person skilled in the art could make various alternations, additions, and omissions without departing from the spirit and scope of the present invention as defined by the appended claims.

WHAT IS CLAIMED IS:

1. A system for providing user mobility between public and private wireless networks, which include a mobility management plane, characterized by:

a private wireless network (10) having a base station (24) operable to communicate with a mobile station (12) over a wireless interface (48); and

a wireless adjunct internet platform (WARP) (26) coupled to the base station (24) and operable to communicate with the mobile station (12) through the base station (24), the WARP (26) further coupled to a home location register (76) in a public wireless network (44) and operable to inform the home location register (76) when the mobile station (12) moves into and out of range of the WARP (26).

2. The system of Claim 1, characterized in that the WARP (26) comprises a location register (95) operable to identify the base station (24) communicating with the mobile station (12).

3. The system of Claim 1, further characterized by a gatekeeper (32) coupled to the WARP (26) and operable to identify the WARP (26) communicating with the mobile station (12).

4. The system of Claim 1, further characterized by a subscriber location register (30) coupled to the WARP (26), the subscriber location register (30) operable to store and retrieve subscriber management information and transmit the management information to the WARP (26).

5. The system of Claim 4, characterized in that the subscriber location register (30) comprises a Visitor Location Register (97) and an Office Location Register (99) coupled to the WARP (26), the Visitor Location Register (26) operable to store and retrieve general subscriber management information, the Office Location Register (99) operable to store and retrieve user management information specific to the private wireless network (10).

6. The system of Claim 1, further characterized by a public land mobile network (PLMN) gateway (70) coupling the WARP (26) and the home location register (76), the PLMN gateway (70) operable to communicate with the WARP (26) and the home location register (76).

7. The system of Claim 6, further characterized by an Internet Protocol (IP) network (20) coupling the WARP (26) and the PLMN gateway (70).

8. The system of Claim 6, characterized in that the WARP (26) communicates with the mobile station (12) using a Global System for Mobile communication (GSM) 04.08 protocol and with the PLMN gateway (70) using an International Telecommunications Union–Telecommunications (ITU-T) H.323 Registration, Admissions, and Status protocol, the WARP (26) comprising an interworking function operable to convert between the protocols.

9. A wireless adjunct internet platform for providing user mobility between public and private wireless networks, which include a mobility management plane, characterized by:

an interface (52) operable to communicate with a mobile station (12) through a base station (24) in a first wireless network (10);

a processor (54) coupled to the interface (52) and operable to communicate with the base station (24), the processor (54) also coupled to a second wireless network (44) and operable to communicate with the second wireless network (44); and

a location register (95) coupled to the processor (54) and operable to identify the base station (24) communicating with the mobile station (12) in the first wireless network (10).

10. The wireless adjunct internet platform of Claim 9, characterized in that the interface (52) comprises a GSM Abis wireline interface.

11. The wireless adjunct internet platform of Claim 9, characterized in that the processor (54) is operable to communicate with the second wireless network (44) over an IP network (20).

12. The wireless adjunct internet platform of Claim 9, characterized in that the processor (54) is operable to communicate with the mobile station (12) using a circuit-switched protocol and with a PLMN gateway (70) using a packet-switched protocol, the processor (54) also operable to perform an interworking function to translate between the circuit-switched protocol and the packet-switched protocol.

13. The wireless adjunct internet platform of Claim 9, characterized in that the location register (95) comprises a random access memory (56).

14. A method of providing user mobility between public and private wireless networks, which include a mobility management plane, characterized by:

registering a mobile station (12) with a wireless adjunct internet platform (WARP) (26) located in a first network (10) when the mobile station (12) begins communicating with the WARP (26) through a base station (24); and

informing a home location register (76) in a second network (44) when the mobile station (12) moves into and out of range of the WARP (26).

15. The method of Claim 14, characterized in that informing the home location register (76) when the mobile station (12) moves into and out of range of the WARP (26) comprises communicating using a GSM Mobile Application Part protocol.

16. The method of Claim 14, further characterized by informing the WARP (26) when the mobile station (12) moves into and out of range of the base station (24).

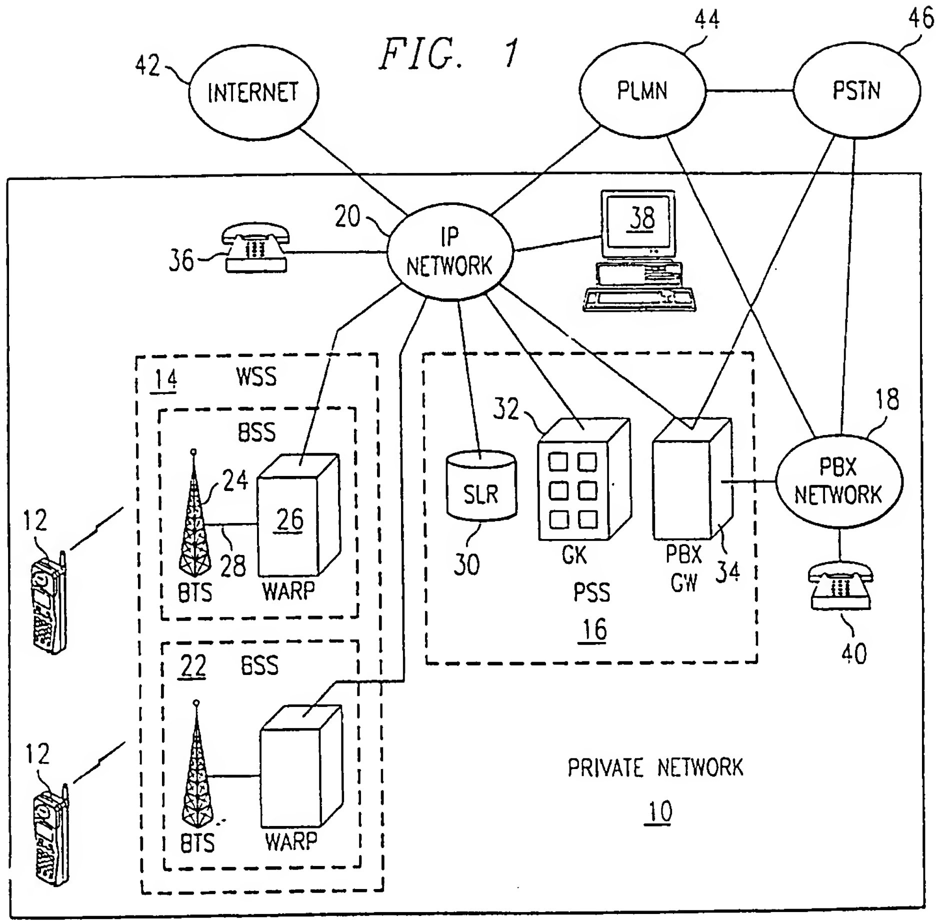
17. The method of Claim 16, characterized in that informing the WARP (26) when the mobile station (12) moves into and out of range of the base station (24) comprises communicating using a GSM 04.08 protocol.

18. The method of Claim 14, further characterized by transferring subscriber management information from a subscriber location register (30) to the WARP (26) when the mobile station (12) registers with the WARP (26).

19. The method of Claim 14, further characterized by informing a gatekeeper (32) when the mobile station (12) moves into and out of range of the WARP (26).

20. The method of Claim 19, characterized in that the step of informing the gatekeeper (32) when the mobile station (12) moves into and out of range of the WARP (26) comprises communicating using an ITU-T H.323 Registration, Admissions, and Status protocol.

FIG. 1


42
INTERNET
44
PLMN
46
PSTN
20
IP NETWORK
36
38
14
WSS
BSS
24
26
28
BTS
WARP
12
22
BSS
BTS
WARP
12
32
SLR
30
GK
PBX GW
34
PSS
16
18
PBX NETWORK
40
PRIVATE NETWORK
10

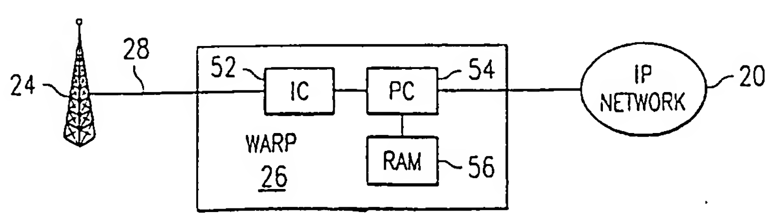
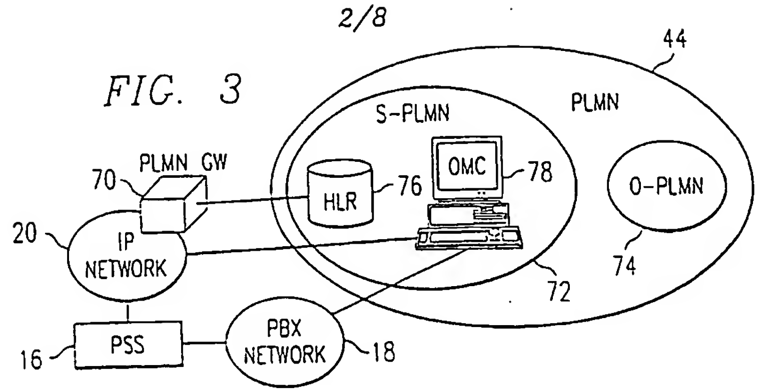

24
28
52
IC
PC
54
WARP
26
RAM
56
IP NETWORK
20

FIG. 2

FIG. 3


44
PLMN
S-PLMN
PLMN GW
70
OMC
78
HLR
76
O-PLMN
20
IP NETWORK
74
72
PSS
16
PBX NETWORK
18

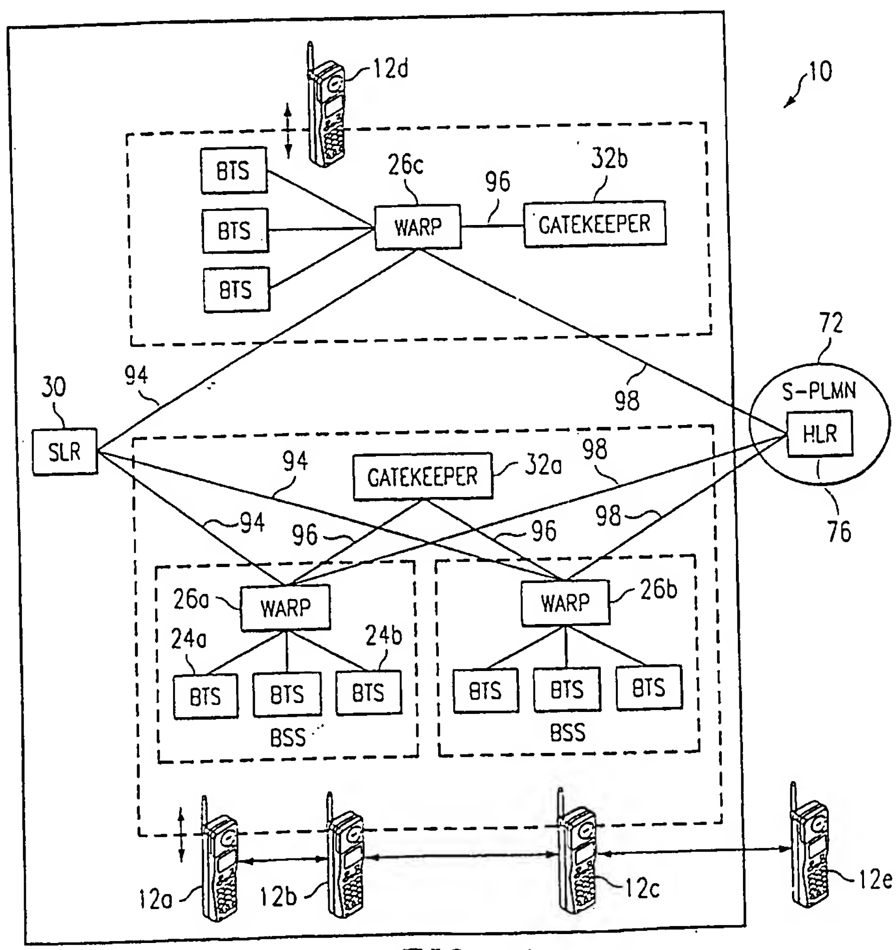

12d
10
BTS
BTS
BTS
26c
WARP
96
32b
GATEKEEPER
72
S-PLMN
HLR
76
30
SLR
94
98
GATEKEEPER
32a
96
26a
WARP
26b
24a
24b
BSS
BSS
12a
12b
12c
12e

FIG. 4

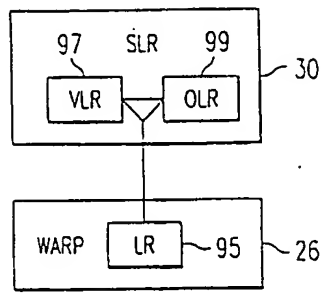

97
SLR
99
30
VLR
OLR
WARP
LR
95
26

FIG. 5

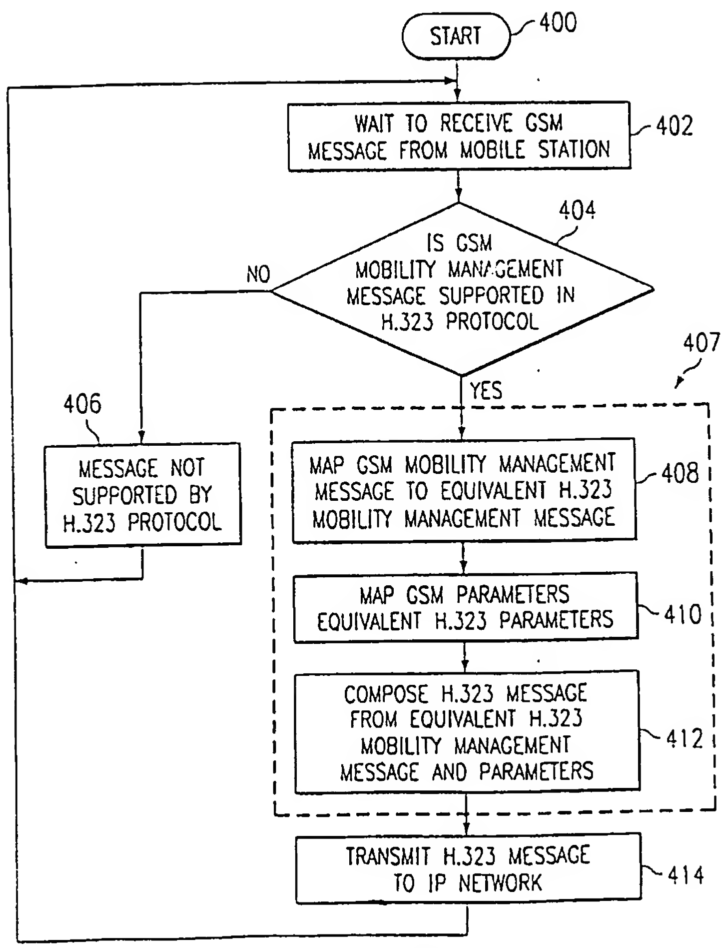

START
400
WAIT TO RECEIVE GSM MESSAGE FROM MOBILE STATION
402
404
IS GSM MOBILITY MANAGEMENT MESSAGE SUPPORTED IN H.323 PROTOCOL
NO
YES
407
406
MESSAGE NOT SUPPORTED BY H.323 PROTOCOL
MAP GSM MOBILITY MANAGEMENT MESSAGE TO EQUIVALENT H.323 MOBILITY MANAGEMENT MESSAGE
408
MAP GSM PARAMETERS EQUIVALENT H.323 PARAMETERS
410
COMPOSE H.323 MESSAGE FROM EQUIVALENT H.323 MOBILITY MANAGEMENT MESSAGE AND PARAMETERS
412
TRANSMIT H.323 MESSAGE TO IP NETWORK
414

FIG. 10

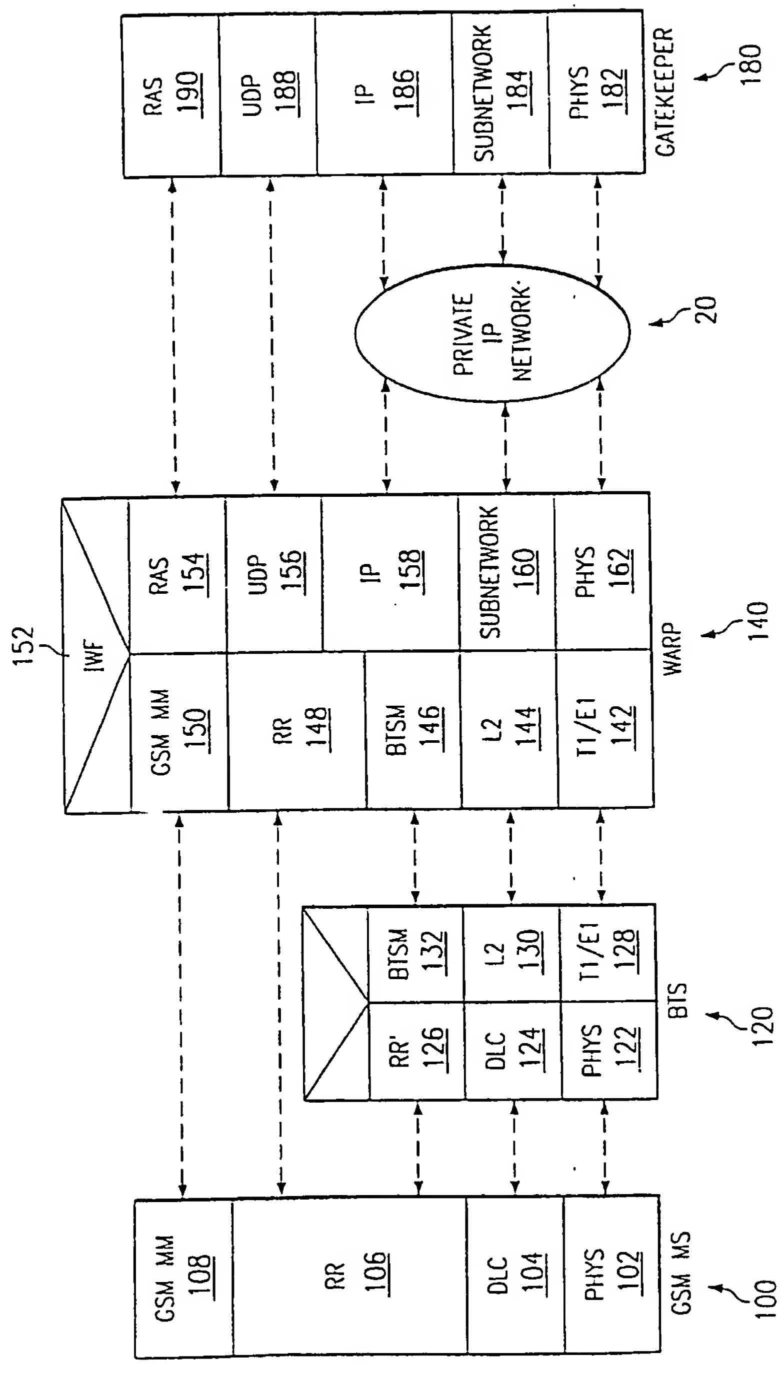

RAS 190
UDP 188
IP 186
SUBNETWORK 184
PHYS 182
GATEKEEPER
180
PRIVATE IP NETWORK
20
152
IWF
RAS 154
UDP 156
IP 158
SUBNETWORK 160
PHYS 162
GSM MM 150
RR 148
BTSM 146
L2 144
T1/E1 142
WARP
140
BTSM 132
L2 130
T1/E1 128
RR' 126
DLC 124
PHYS 122
BTS
120
GSM MM 108
RR 106
DLC 104
PHYS 102
GSM MS
100

FIG. 6

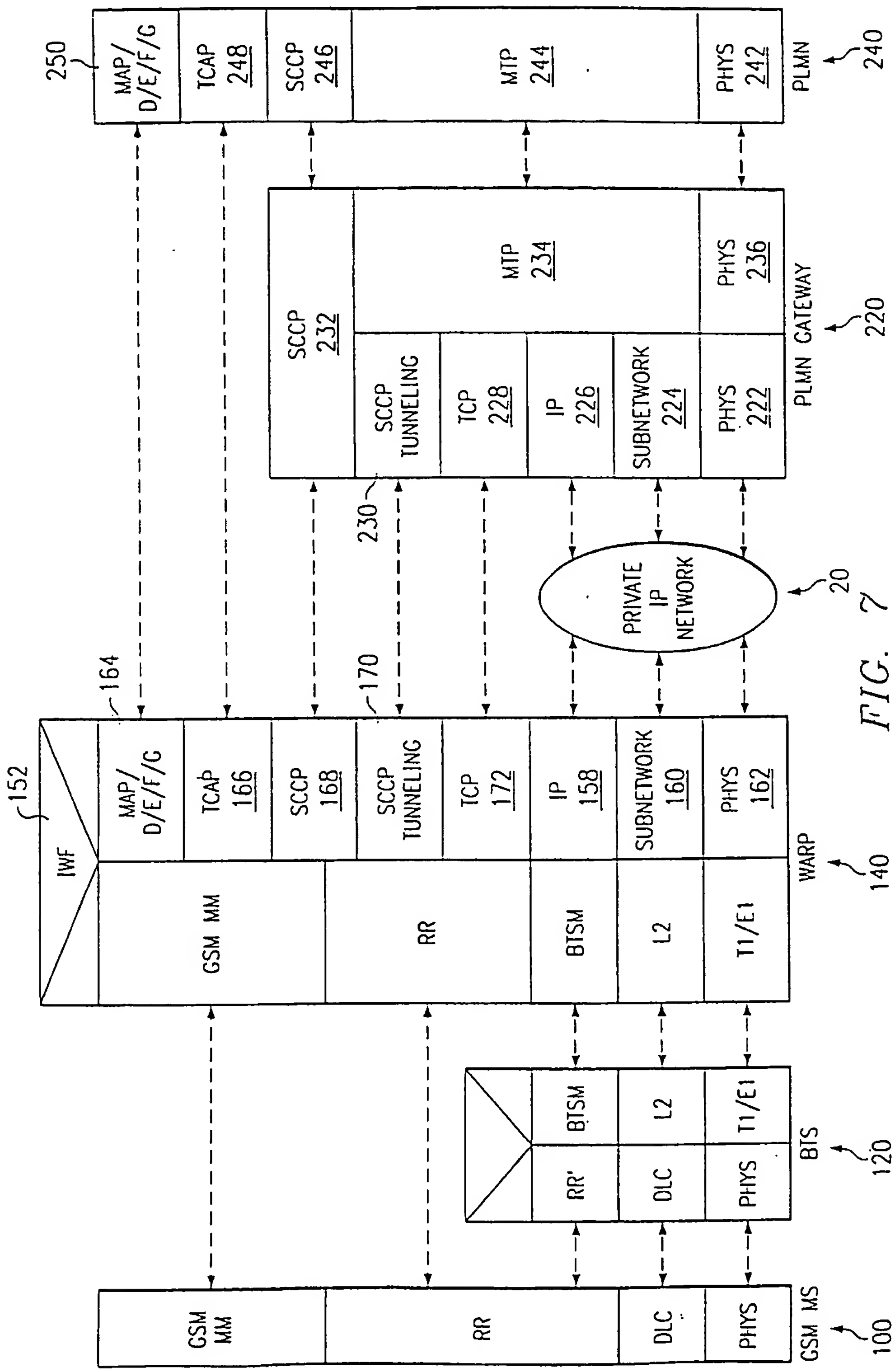

MAP/
D/E/F/G
250
TCAP
248
SCCP
246
MTP
244
PHYS
242
PLMN
240
SCCP
232
MTP
234
PHYS
236
SCCP
TUNNELING
230
TCP
228
IP
226
SUBNETWORK
224
PHYS
222
PLMN GATEWAY
220
PRIVATE
IP
NETWORK
20
IWF
152
MAP/
D/E/F/G
164
TCAP
166
SCCP
168
SCCP
TUNNELING
170
TCP
172
IP
158
SUBNETWORK
160
PHYS
162
GSM MM
RR
BTSM
L2
T1/E1
WARP
140
BTSM
L2
T1/E1
RR'
DLC
PHYS
BTS
120
GSM
MM
RR
DLC
PHYS
GSM MS
100

FIG. 7

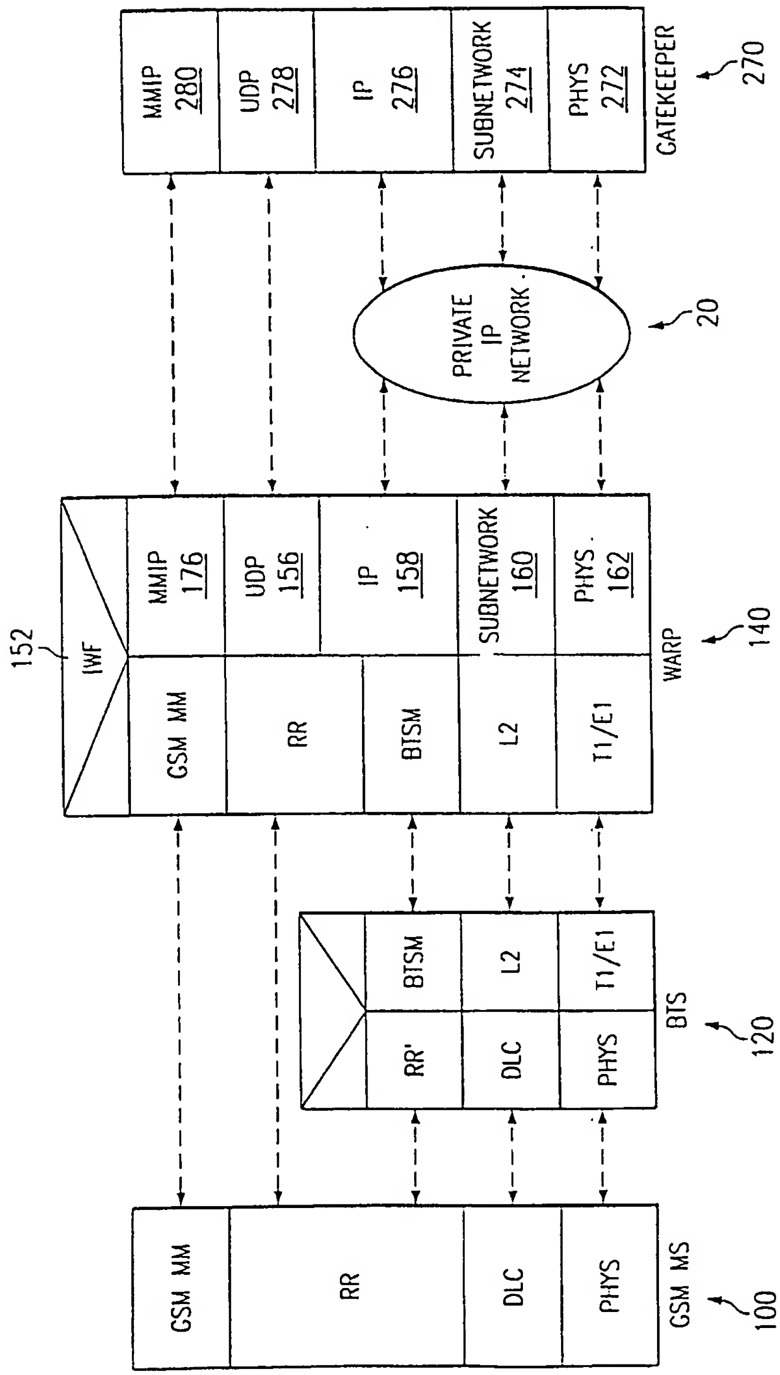

MMIP 280
UDP 278
IP 276
SUBNETWORK 274
PHYS 272
GATEKEEPER
270
PRIVATE IP NETWORK
20
152
IWF
MMIP 176
UDP 156
IP 158
SUBNETWORK 160
PHYS 162
GSM MM
RR
BTSM
L2
T1/E1
WARP
140
BTSM
L2
T1/E1
RR'
DLC
PHYS
BTS
120
GSM MM
RR
DLC
PHYS
GSM MS
100

FIG. 8

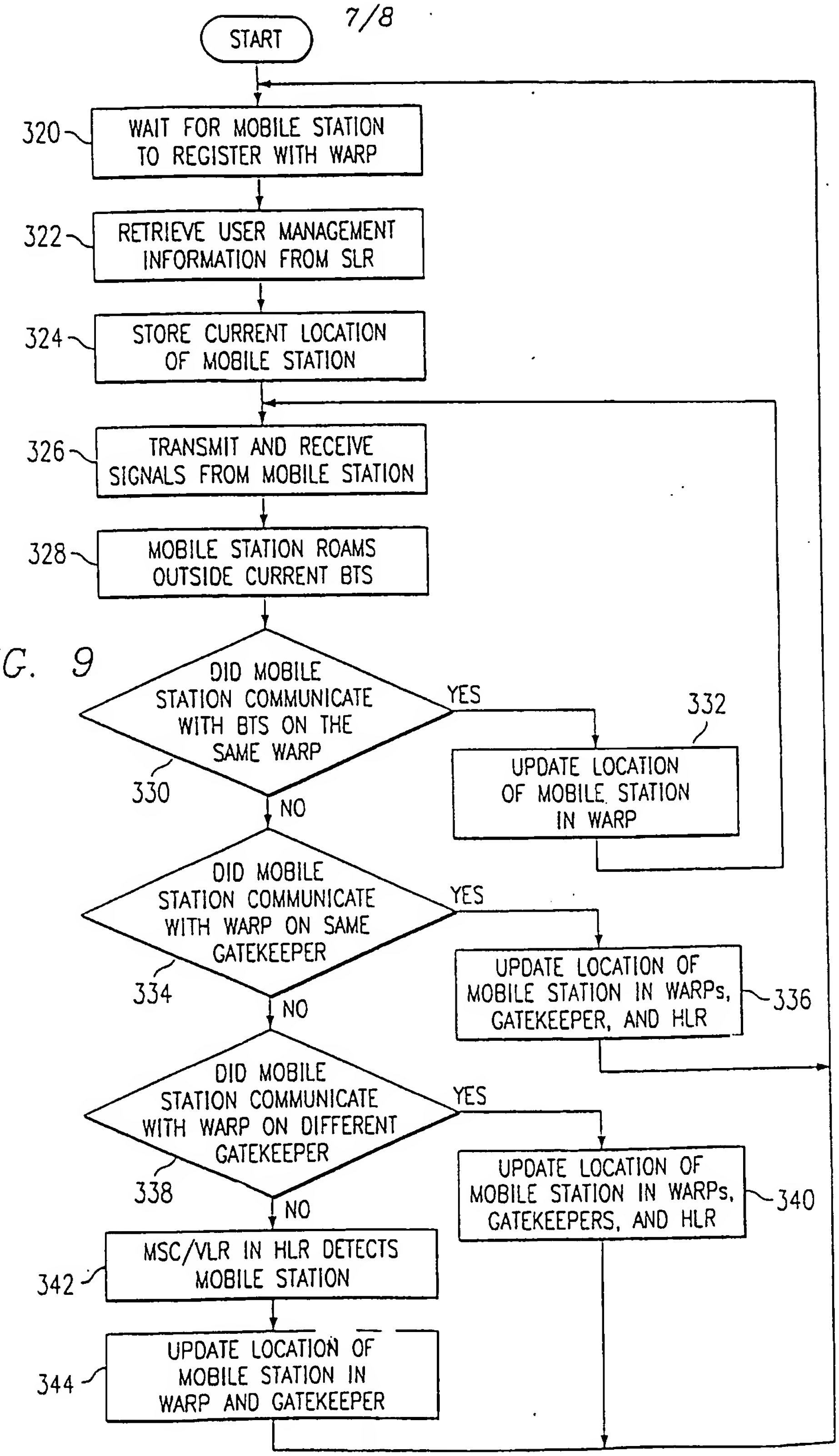

START
320
WAIT FOR MOBILE STATION TO REGISTER WITH WARP
322
RETRIEVE USER MANAGEMENT INFORMATION FROM SLR
324
STORE CURRENT LOCATION OF MOBILE STATION
326
TRANSMIT AND RECEIVE SIGNALS FROM MOBILE STATION
328
MOBILE STATION ROAMS OUTSIDE CURRENT BTS
DID MOBILE STATION COMMUNICATE WITH BTS ON THE SAME WARP
330
YES
NO
332
UPDATE LOCATION OF MOBILE STATION IN WARP
DID MOBILE STATION COMMUNICATE WITH WARP ON SAME GATEKEEPER
334
YES
NO
UPDATE LOCATION OF MOBILE STATION IN WARPs, GATEKEEPER, AND HLR
336
DID MOBILE STATION COMMUNICATE WITH WARP ON DIFFERENT GATEKEEPER
338
YES
NO
UPDATE LOCATION OF MOBILE STATION IN WARPs, GATEKEEPERS, AND HLR
340
MSC/VLR IN HLR DETECTS MOBILE STATION
342
UPDATE LOCATION OF MOBILE STATION IN WARP AND GATEKEEPER
344

FIG. 9

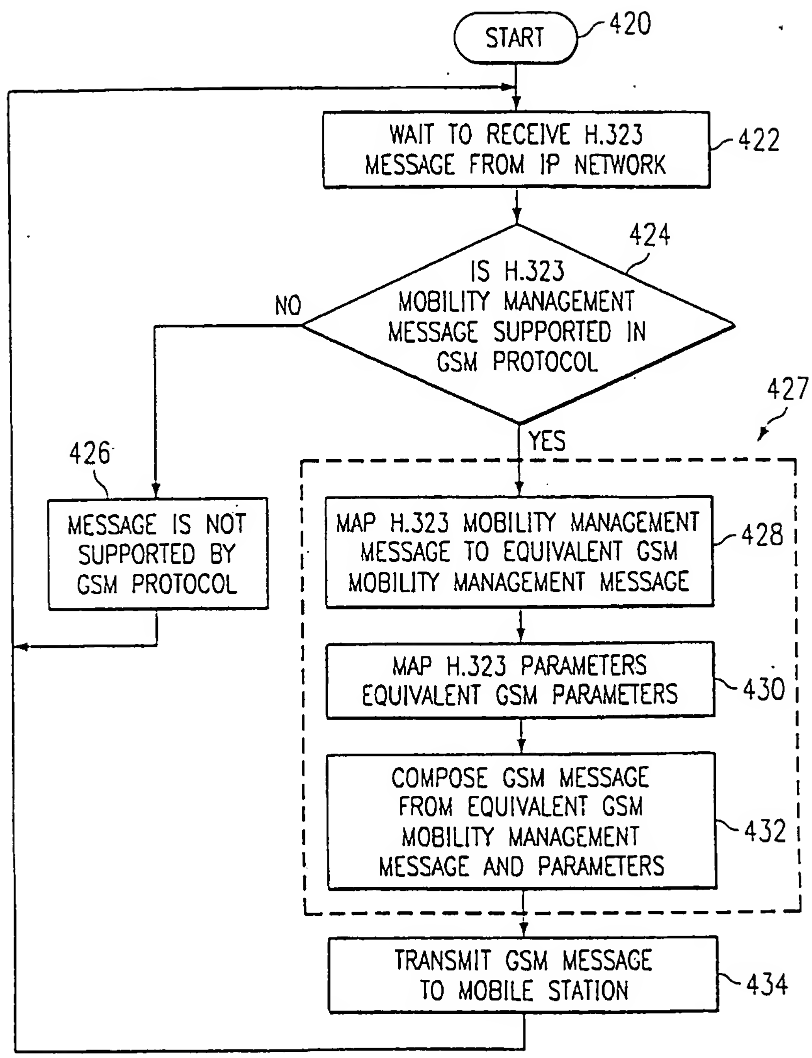

START
420
WAIT TO RECEIVE H.323 MESSAGE FROM IP NETWORK
422
IS H.323 MOBILITY MANAGEMENT MESSAGE SUPPORTED IN GSM PROTOCOL
424
NO
YES
426
MESSAGE IS NOT SUPPORTED BY GSM PROTOCOL
427
MAP H.323 MOBILITY MANAGEMENT MESSAGE TO EQUIVALENT GSM MOBILITY MANAGEMENT MESSAGE
428
MAP H.323 PARAMETERS EQUIVALENT GSM PARAMETERS
430
COMPOSE GSM MESSAGE FROM EQUIVALENT GSM MOBILITY MANAGEMENT MESSAGE AND PARAMETERS
432
TRANSMIT GSM MESSAGE TO MOBILE STATION
434

FIG. 11

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(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

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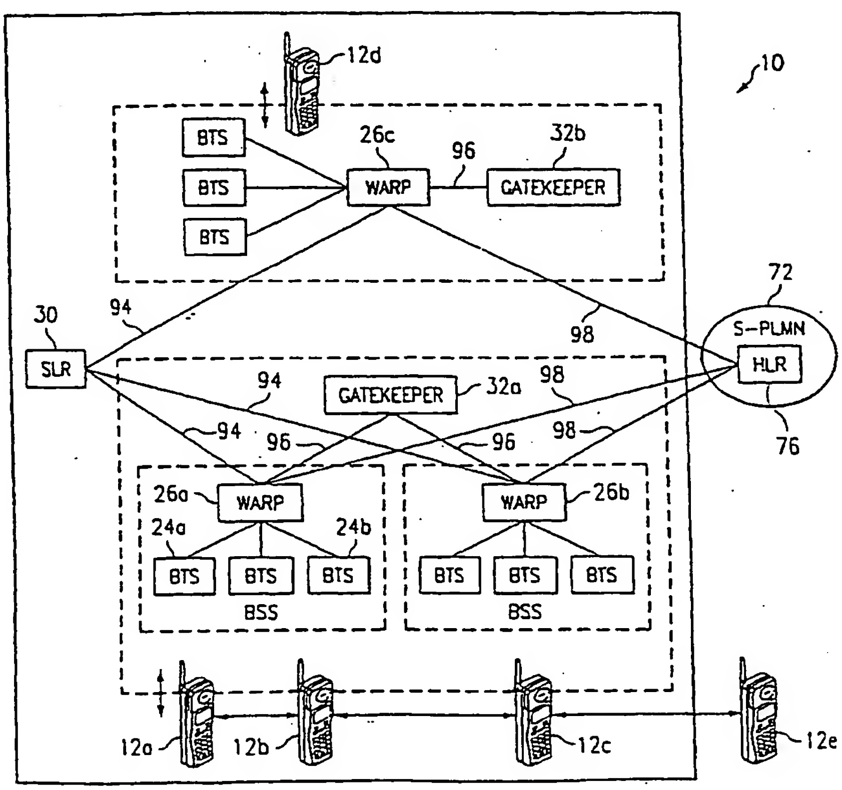
(54) Title: METHOD AND SYSTEM FOR PROVIDING USER MOBILITY BETWEEN PUBLIC AND PRIVATE WIRELESS NETWORKS



(57) Abstract: A system for providing user mobility between public and private wireless networks includes a private wireless network (10) having a base station (24) operable to communicate with a mobile station (12) over a wireless interface (48). The system also includes a wireless adjunct internet platform (WARP) (26) coupled to the base station (24) and operable to communicate with the mobile station (12) through the base station (24). The WARP is further coupled to a home location register (76) in a public wireless network (44) and is operable to inform the home location register (76) when the mobile station (12) moves into and out of range of the WARP (26).

WO 01/60085 A2